Efficacy of Plant Growth Regulators for the Removal of Annual Bluegrass from a Creeping Bentgrass Putting Green

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Introduction

Annual bluegrass (*Poa annua*: ABG) can be an undesirable and invasive plant in creeping bentgrass (*Agrostis stolonifera*: CBG) putting greens; thus, ABG suppression is an important turf management practice for some turf areas. ABG has displeasing aesthetic and playability features including a light yellow/green color and profuse flowering and seed head production (Cox et al., 2003). Common plant growth regulators (PGRs) used in turfgrass maintenance alter gibberellic acid (GA) production and accumulation, which can alter shoot growth on putting green species. Previous studies have shown that these PGRs can suppress ABG seed head and growth more than CBG allowing CBG to grow more laterally into suppressed ABG areas (Turgeon et al., 2009). Newer PGRs products include combinations of two or more chemistries to provide enhanced growth regulation while also decreasing the amount of ABG present. A better understanding of these PGR chemistries in controlling ABG in a CBG putting green could prove to be beneficial to golf course superintendent wishing to control or remove ABG from their putting greens

Objectives

- Evaluate the efficacy of PGRs and combinations of PGRs on controlling ABG within a CBG putting green.

Hypothesis

- Combination PGR products which contain two or more PGR chemistries will decrease ABG within a CBG putting green more than a single PGR.
- PGRs will increase CBG performance characteristics such as turf quality and dark green color index (DGCI) and may reduce stress indices.

Materials and Methods

Putting green constructed in 2003

- Creeping bentgrass 'Crenshaw'
- Mowed to a height of 0.33 cm three times weekly

PGR treatments	Rate
Trinexapec-ethyl (TE)	0.643 L/ha
Flurprimidol (F)	0.497 L/ha
Paclobutrizole (P)	0.321 L/ha
Flurprimidol+Trinxapec-ethyl (F + TE)	0.584 L/ha
Flurprimidol+Paclobutrizole +Trinexapec-ethyl (F + P + TE)	0.730 L/ha
Methiozolin (M)	3.822 L/ha

- Applications were made once every two weeks beginning on 14 June 2016 and continued through October.

Measurements and Data Analysis:

- Turf quality (TQ) – TQ ratings were on a 1-9 scale (1= necrotic grass and 9 = green, healthy grass) (Turgeon, 2008).
- Dark green color index (DGCI) – Digital image analysis was performed for dark green color index (Karcher and Richardson, 2013).
- Stress 1 and 2 indices (ST1, ST2) – Multispectral radiometry measurements were performed with the MSR16 (CropScan16, Inc., Rochester, MN) Stress 1 (R_{706}/R_{760}), and Stress 2 (R_{706}/R_{813}) were calculated.
- Percent ABG (%) – was determined through the use of a grid (1.1 x 1.4 m) with 285 intersections. ABG invasion was measured by counting the number of grid intersections which touched any part of an annual bluegrass plant (Park and Landschoot, 2003)
- Experimental Design and Statistical Analysis – The experiment was set up as a randomized complete block design with three replications. Analysis of variance was determined according to the general linear model procedure in SAS version 9.4 (SAS institute, Cary, NC). Means separated based on Fischer's protected least significant difference (LSD) test ($P \leq 0.05$).

Results

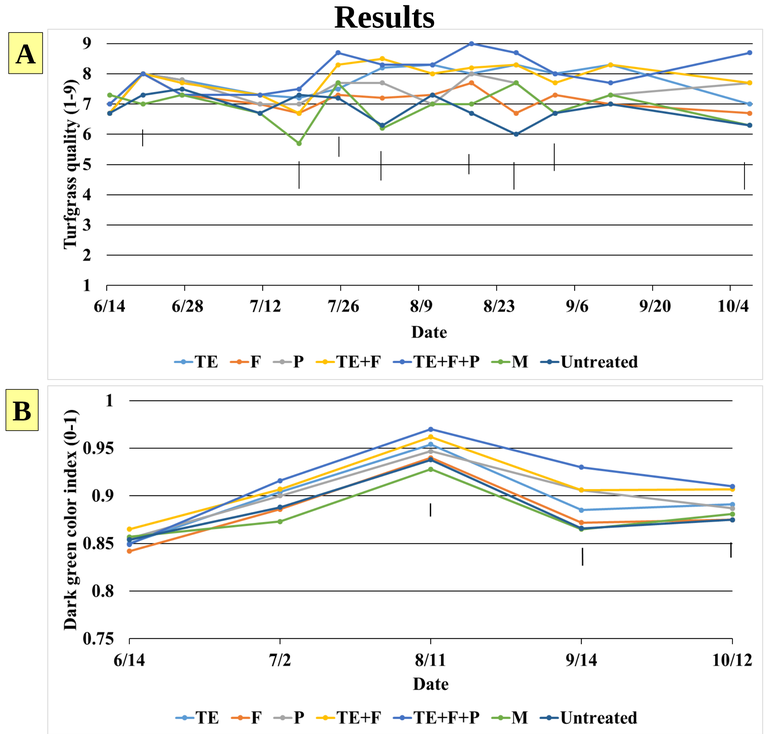

Figure 1. **A**. Turf quality (9= healthy, 1= necrotic), **B.** Dark green color index (DGCI) using digital image analysis, **C**. Stress 1 index (ST1) using multispectral radiometry, and **D**. Stress 2 index (ST2) using multispectral radiometry of creeping bentgrass in 2016 under PGR treatments. Vertical least significant difference (LSD) bars represent least significant difference values ($P \leq 0.05$) for treatment comparison at a given day of treatment.

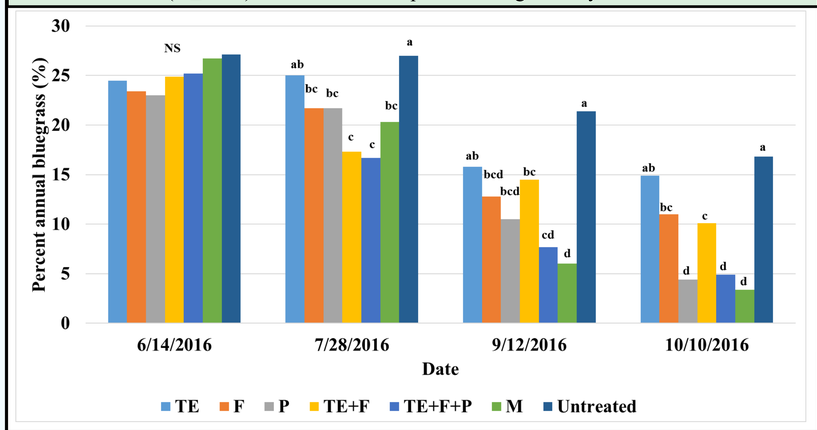

Figure 2. Percent ABG in CBG plots measured by using the line intersecting grid method with a grid containing 285 intersections in 2016 under PGR treatments. Different letters indicate significant differences among PGR treatments within a given day. Within columns, means followed by the same letter are not significantly different. NS indicates not significant; Fisher's least significant difference at $P \leq 0.05$.

Discussion

Figure 1. A. Visual turfgrass quality

- TE, TE + F, and TE + F + P treated plots resulted in the highest quality when data were significant when compared to the control.
- M treated plots were not statistically different from the untreated except for two dates in which one resulted in lower quality and one date higher quality.

Figure 1. B. Dark green color index

- TE + F + P always had the highest DGCI when compared to other treatments when data were significant.
- TE + F had the same DGCI as TE + F + P except for one date in which it was lower.
- M, F and untreated were not different from one another which also resulted in the lowest DGCI.

Figure 1. C. Stress 1 index

- TE + F + P had lowest reflectance on last date data were significant.
- Untreated and M were highest on the last date compared to other treatments.

Figure 1. D. Stress 2 index

- P, F + TE, and F + P + TE had the lowest stress index 3 of 4 dates.
- M and untreated had the highest stress index on all 4 dates.

Figure 2. Percent annual bluegrass

- M and TE + F + P treated plots resulted in the least amount of ABG when compared to other treatments.
- TE treated plots areas were no different than untreated control plots.
- ABG percent declined throughout the summer between rating dates.

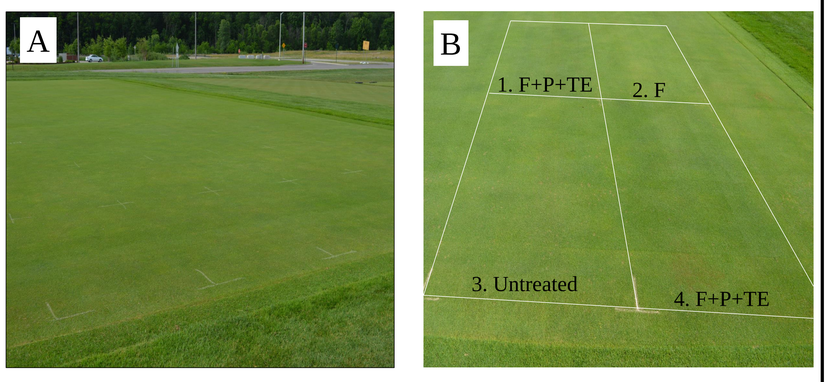

Figure 3. A. Plot areas prior to PGR treatment initiation on creeping bentgrass, taken on 6/14/16. **B**. Plot areas after PGR treatments have been applied on creeping bentgrass, taken on 8/26/16.

Conclusions

- M and TE + F + P had the lowest amount of ABG when compared to the untreated control plots.
- TE treated CBG was never different in ABG percent when compared to the untreated controls.
- F and P treatments resulted in less ABG than the untreated control.
- PGR treatments lowered stress indices when compared to M and untreated
- Applying multi-chemistry plant growth regulators can be beneficial to controlling ABG from a CBG putting green while increase CBG quality and dark green color.

Future Work

A second year of data will be obtained in the summer of 2017. Further evaluation of PGRs at different concentrations and application timings could prove to be valuable information for turfgrass managers desiring to reduce ABG from CBG putting greens.

Citations:

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